# PROCEEDINGS OF THE SEVENTH ANNUAL MEETING OF THE AMERICAN INSTITUTE OF NUTRITION

JUNG HOTEL, NEW ORLEANS, MARCH 13, 1940

The seventh annual meeting of the American Institute of Nutrition was held in New Orleans at the Jung Hotel on March 13, 1940. One hundred and ten members and 340 guests registered.

## COUNCIL MEETING

The Council meeting was held at the Jung Hotel, Tuesday evening, March 12, at 6:30 P.M. All members were present. Formal actions of the Council are reported in the minutes of the Business Session.

## SCIENTIFIC SESSIONS

The scientific program began at 9:00 A.M. and proceeded on schedule time. All the papers listed on the program were given. President Sherman presided at the morning session and Vice-President Carpenter at the afternoon session. The Symposium program held in the evening under the chairmanship of President Sherman was attended by about 800 persons and lasted for approximately 1½ hours. The carefully prepared papers provided an integrated program on the problem of better health which proved unusually interesting and thought-provoking.

## BUSINESS SESSION

The business meeting was called to order by President Sherman at 11:30 A.M., March 13th. The reading of the minutes of the previous annual meeting was dispensed with since they had been published in the Journal.

The Secretary announced that, in accordance with the by-law providing that members in good standing who have reached the age of 65 years shall become emeritus members, A. J. Carlson, E. B. Hart, J. R. Murlin, and Mary S. Rose have attained this rank of service. The following resignations were reported, effective June 30, 1940: Oscar M. Schloss and C. A. Lilly.

The Secretary announced that the results of the mail vote relative to the question of making application for membership in the Federation were as follows: 158 affirmative and 7 negative; that the application had been made accordingly and would presumably be acted upon at the current meeting of the Federation. He stated that the correspondence dealing with this matter, most of which had been circulated to the membership, had been filed in the minutes of the Council. Upon recommendation of the Council it was voted that, in view of this pending application to the Federation, the questions of time, place and nature of the program for the 1941 meeting be left to the Council with power.

The Secretary announced that the Committee of Judges for the 1940 Mead Johnson Award consisted of F. F. Tisdall, chairman, E. V. McCollum, W. C. Rose, H. T. Parsons, and H. B. Lewis, and that its report which had been approved by the Council would be made at the Dinner.

By request of the Council the Secretary read excerpts of a letter from Dr. Icie Macy Hoobler relative to the recent "White House Conference on Children in a Democracy." The letter cited the recommendation of this conference that "in recognition of the fundamental importance of nutrition to the health of children, the President appoint a National Nutrition Committee, composed of scientists, physicians, agricultural experts, consumers' representatives, teachers, and administrators." The letter also expressed the conviction that the Institute should get behind this great movement which should give impetus to a national program of action and which would mean more food of the right kind for more children.

The Secretary announced that in the absence of any specific provision in the By-Laws the Council had established the fiscal year of the Institute as March 1–February 28.

The report of the Treasurer was read by W. H. Sebrell. The auditors, T. M. Carpenter and P. E. Howe, previously appointed by the President, reported that they had examined the Treasurer's books and found them correct. It was moved and carried that the report of the Treasurer be accepted.

G. R. Cowgill reported as Editor. The items mentioned by him are included in the formal report of the Editorial Board, which is included later.

The Secretary reported that during the past year Dr. Cowgill, upon being elected Editor of the Journal, had resigned as Treasurer and that, in accordance with the By-Laws, the nominating committee had selected W. H. Sebrell to fill the vacancy created by Dr. Cowgill's resignation. The Secretary also announced that the National Savings and Trust Company of Washington, D.C. had been designated by the Council as the official depository for the funds of the Institute.

The Tellers, R. C. Lewis and W. D. Salmon, reported that in the annual election 96 votes had been cast with the following choices:

President—T. M. Carpenter
Vice-President—A. G. Hogan
Treasurer—W. H. Sebrell
Secretary—L. A. Maynard
Councillor—Lydia J. Roberts
Associate Editors (for 4 years)—Lela E. Booher
H. B. Lewis
A. T. Shohl
Associate Editor (for 1 year)—E. B. Forbes

Dr. E. M. Nelson made the following recommendation in behalf of the Committee on Vitamin Nomenclature:

> "It is recommended that the name PYRIDOXINE be adopted for the compound which has been identified as 2 methyl 3 hydroxy 4,5 di-(hydroxymethyl) pyridine and which has previously been designated by several names including vitamin $B_6$."

It was moved and carried that this recommendation be adopted. Dr. Nelson also reported that a name for vitamin K was under consideration.

Upon recommendation by the Council it was voted to ask the President to appoint a Committee to consider desirable changes in the Constitution and By-Laws. President Sherman appointed the following as members of this Committee: A. H. Smith, Chairman, Grace MacLeod, and L. A. Maynard.

President Sherman announced the appointment of the following Nominating Committee for 1940–41: H. H. Mitchell, Chairman, P. M. Nelson, Jennie Rowntree, C. E. Bills, G. O. Burr.

The Council recommended that the following candidates be elected to membership:

E. W. Crampton
L. A. Crandall
H. G. Day
Lillian N. Ellis
Margaret L. Fincke
H. H. Gordon
A. Baird Hastings
Robert C. Lee
L. L. Madsen
Lane A. Moore
E. S. Nasset
P. V. Pearson
Sybil L. Smith

It was moved and seconded that the Secretary cast a unanimous vote for the election to membership of the candidates approved by the Council. The motion carried and the Secretary declared the candidates duly elected members of the American Institute of Nutrition.

It was voted to refer to the new Committee on Revision of the Constitution and By-Laws the question of providing a choice in the nominations made for at least one of the elective offices.

It was moved, seconded, and unanimously voted that the Secretary be instructed to write a letter to J. R. Murlin expressing the deep appreciation of the Institute for his pioneer work in founding The Journal of Nutrition and for his long, devoted and outstanding service as Editor.

It was moved and carried that the Secretary be instructed to extend for the members of the American Institute of Nutrition and their guests their sincere thanks to the Local Committee and the management of the Jung Hotel for the excellent arrangements provided for the meeting and for the many courtesies extended.

The meeting adjourned at 12:30 P.M.

## LUNCHEON

The noon luncheon in the Mirror Room was attended by 132 members and guests.

## DINNER

The subscription dinner held in the Jung Roof was attended by 231 members and guests.

The presentation of the Mead Johnson and Company Award for Research on the Vitamin B Complex for 1940 was made, in behalf of the Institute, by E. V. McCollum, a member of the Committee of Judges. One-half of the Award was presented to W. H. Sebrell for his work on riboflavin deficiency in man. In response, Dr. Sebrell paid tribute to the pioneer work of Dr. Goldberger and spoke feelingly of the inspiration and guidance he had received from this outstanding investigator. He also acknowledged the devoted assistance of his associate, R. E. Butler.

The other half of the Award was divided among the following investigators for their work on the isolation, structure, and synthesis of vitamin $B_6$: J. C. Keresztesy, J. R. Stevens, S. A. Harris, E. T. Stiller, and Karl Folkers. Dr. Keresztesy responded in behalf of this group. He related the thrills experienced as the various discoveries were made. He emphasized that they were the result of close team work and he paid tribute to the cooperation of both the officers and other employees of Merck and Company.

## EDITORIAL BOARD

Dr. John R. Murlin resigned as Editor at the last annual meeting. The Editorial Board elected the new editor in June, 1939. The Wistar Institute asked Dr. Murlin to see through the press papers in the issues of The Journal of Nutrition up to and including that of October, 1939, which was done.

During the period of 5 months (November, 1939 to March, 1940) under the new editorial management forty-seven articles were published. Twenty-three papers were rejected for various reasons and one was withdrawn by its author. For this 5-month period the average number of pages per article proves

to be 10.8, indicating that the policy of the Editorial Board of making this average approximate the figure 10 is being followed. The number of articles per volume continues to increase slightly. In the last annual report (see Supplement, J. Nutrition, vol. 17, June, 1939) data are tabulated covering volumes 13 to 17, inclusive and showing that the number of articles per volume has risen from 48 to 55; volume 18 carried 56 papers. Two articles from foreign countries were accepted.

Beginning with volume 19, the first issue of which appeared in January, 1940, a new picture, that of Claude Bernard, has appeared on the cover page. This change was in keeping with the policy of using a new picture every 3 years or every six volumes. The January, 1940 issue also carried another change with respect to the kind of paper used in printing the Journal. The type of stock now used is tougher and has certain other advantages over the paper formerly used.

Hitherto The Journal of Nutrition has not been copyrighted. The publisher, The Wistar Institute, recently notified the editor that, beginning with the July, 1940 issue, all issues will be copyrighted. This will serve to protect both authors and publishers against any unauthorized reprinting of articles that have appeared in the Journal.

Discussion with the publisher of the question of printing three volumes a year, or enlarging the present two volumes has continued, but no change has been decided upon as yet. Until greater financial support can be secured for the Journal, it will be difficult to make such a change without appreciably increasing the cost to subscribers.

During the luncheon hour on March 13, 1940, a meeting of the Editorial Board was held at the Jung Hotel. The problems facing the editor in making decisions on papers, the ways in which members of the Board can assist in their solution, and related topics were discussed.

Respectfully submitted,

L. A. MAYNARD
American Institute of Nutrition

## ABSTRACTS OF PAPERS

*Pantothenic acid and its nutritional significance.* Roger J. Williams (introduced by Jet C. Winters), Department of Chemistry, University of Texas, Austin.

The discovery and isolation of the vitamin which we have named pantothenic acid came about unconventionally inasmuch as it resulted from experimentation with microorganisms rather than with animals.

While a number of the recognized vitamins (thiamin, riboflavin, nicotinamide, adermin) have profound physiological effects on microorganisms, pantothenic acid is the only one discovered and isolated using microorganisms for biological testing.

The general importance of pantothenic acid in the whole field of biology is indicated by its presence in all tissues, and in every form of plant, animal and bacterial life examined. It likewise affects the respiration of widely different tissues. Its importance in the nutrition of the chick has been fully demonstrated, and its indispensability for rats seems certain. Its presence in the food is evidently unusually important during the early stages of growth of mammals. Milk is relatively rich. It is difficult to deplete rats, after weaning, with respect to this vitamin. They obtain it from milk and store it in the liver and other tissues, where it is built into colloidal constituents. Chicks, however, are easily depleted and the content of their tissues may be diminished 50% or more during a 14-day feeding period. Squabs after a period of growth on "crop milk" can live for an extended time receiving only small amounts of pantothenic acid.

The chemical structure of pantothenic acid will be elucidated.

*Experimental vitamin $B_1$ deficiency in man.* R. D. Williams (by invitation), H. L. Mason (by invitation), and R. M. Wilder, Mayo Foundation, Rochester.

A diet containing less than 0.1 mg. (30 I.U.) vitamin $B_1$ (thiamin) daily but adequate in other respects was consumed by eight active young women. The purpose was to produce and study a state of vitamin $B_1$ deficiency unassociated with disease states, starvation or unusual environmental stress. Two subjects were maintained on an identical regime with the exception that a maintenance dose of thiamin was given by mouth.

Urinary excretion of thiamin was determined at weekly or daily intervals and related to the appearance of fatigue, anorexia, achlorhydria, electrocardiographic changes, disturbances of carbohydrate utilization as reflected in diabetic type blood sugar time curves and abnormal accumulation of metabolites, pyruvic and lactic acids. Fatigue was correlated with record of work and studies of oxygen deficit. The time of appearance of symptoms and signs of the deficient state varied widely, but in every case urinary excretions of thiamin fell to extraordinarily low levels.

Striking electrocardiographic changes and other manifestations incident to the induced state of deficiency quickly disappeared when relatively small doses of thiamin were given by injection. The observations encourage us to believe that estimates of thiamin excretion before and after a standard dose of thiamin may serve as an index of borderline states of vitamin $B_1$ deficiency.

*Metabolism of citric acid and of food citrate in infants.* A. H. Smith, D. J. Barnes (by invitation), and C. E. Meyer (by invitation), Department of Physiological Chemistry, Wayne University College of Medicine and Harper Hospital, Detroit.

Eight infants varying from 3½ months to 12 months of age were maintained on an adequate diet of cereal, milk, *B*-lactose and strained fruits. Quantitative collections of urine and feces were made separately in 3-day periods. On the diet alone the excretion of citrate in the urine varied from 12.9 to 6.6% of that ingested and in the feces, 13.0 to 1.9%. During the experimental period 365 mg. of citric acid per kilogram body weight was given by gavage, in addition to the basal diet. Absorption of this increased amount of citrate varied from 76 to 99% of the total consumed; the fecal output was 24.1 to 0.8% (diarrhea being correlated with the high fecal loss) and urinary excretion varied from 3.8 to 0.9%, of the total intake. The data show that foods ordinarily given to infants contain considerable citrate and that this citrate largely disappears in the course of metabolism. Addition of considerable amounts of free citric acid to the basal diet results in a greatly diminished excretion of citrate in the urine and (if diarrhea is absent) in the feces. The data can be interpreted to indicate that free citric acid is not only completely metabolized by the infant but that it causes a reduction in the amount synthesized in the course of metabolism.

*The biological activity of pyrazine acids and quinolinic acid.* W. J. Dann, H. I. Kohn (by invitation), and P. Handler (by invitation), Department of Physiology, Duke University, Durham.

Under our standard conditions a dog with acute blacktongue can be cured with 2 mg. nicotinic acid per kilogram body weight daily for 5 days. This amount of nicotinic acid could not be effectively replaced by pyrazine monocarboxylic acid up to 10 mg., by pyrazine 2,3-dicarboxylic acid up to 14 mg. or by quinolinic acid up to 14 mg. With each compound the results were irregular; some dogs showed remission of mouth symptoms but did not regain normal weight, while others died.

In preventive tests it is known that 0.13 mg. of nicotinic acid per kilogram daily will maintain a dog free from blacktongue over several months (Birch; J. Nutrition, vol. 17, p. 281). We have found that 3 mg. pyrazine monocarboxylic acid, or 4 mg. pyrazine 2,3-dicarboxylic acid, or 2 mg. quinolinic acid per kilogram daily did not prevent the onset of blacktongue within 2 months.

Nicotinic acid in large doses by mouth causes an increase in the V-factor (coenzymes I & II possibly plus unknown related substances) of human blood cells in vivo; when defibrinated human blood is incubated with nicotinic acid in vitro the cells synthesize V-factor (Kohn and Klein; J. Biol. Chem., vol. 130, p. 1). Neither of these effects followed when nicotinic acid was replaced by pyrazine monocarboxylic acid, by pyrazine 2,3-dicarboxylic acid or by quinolinic acid in equivalent or greater amount.

*Man's utilization of dietary calcium.* J. P. Outhouse, R. Mills (by invitation), H. Breiter (by invitation), B. McKey (by invitation), E. Rutherford, W. Armstrong (by invitation), and H. H. Mitchell, Departments of Home Economics and Animal Husbandry, University of Illinois, Urbana.

In these studies calcium balances have been determined at two levels of intake, both of which were lower than that required for maximum retention by the child,

or for equilibrium by the adult. Percentage utilization values were computed on the basis of the differences in calcium retention (or in losses) on the two levels of intake. The length of the periods ranged from 35 to 70 days each. Seven little boys, given $CaHPO_4$, in addition to their basal food, were able to utilize only 19.0% of its calcium. Five of these children, while receiving $CaHPO_4$, were given a daily supplement of lactose (C.P.) in an amount equivalent to that in 750 cc. milk. In all five subjects the calcium retentions were increased, the increase ranging from 8 to 83%; the average value for the group was 33%.

The utilization by seven adults of the calcium of carrots has been studied. Seven hundred grams carrots were eaten daily; the range in calcium utilization values was from 0 to 33% with an average value of 14.0%. The low values for six of the subjects necessitated a determination of the extent to which they utilized the calcium of milk. Preliminary data indicate a higher utilization of milk calcium.

*Human nutritional anemia in Florida.* O. D. Abbott (introduced by L. A. Maynard), C. F. Ahmann (by invitation), and M. R. Overstreet (by invitation), Division of Nutrition, Florida Agricultural Experiment Station, Gainesville.

An examination of 2277 rural school children in Florida showed that 52% of them were anemic, 25% had borderline anemia, while only 22% had normal hemoglobin values. It was found that in those districts, where the predominant soils were classed as deficient in regard to salt lick of cattle, from 52 to 96% of the children were anemic but in districts where the soils were classed as protected, from 0 to 23% were anemic. The iron content of turnip greens (selected as an index food) varied from 258 p.p.m. when grown on protected soils to 56 p.p.m. when grown on deficient ones. The iron content of the diets of children obtaining the greater part of their food from these soils varied likewise. That the anemic condition was due to a mineral deficiency was demonstrated by treating 400 anemic children with ferric ammonium citrate. Within 4 to 6 weeks after beginning treatment all the subjects showed marked improvement. It appears that soil deficiencies operating through plants grown thereon and ultimately on the health of the people is a factor that should be considered in any section where nutritional anemia is endemic.

*The relation of dietary protein to hemoglobin formation in the rat.* A. U. Orten (by invitation) and J. M. Orten, Department of Physiological Chemistry, Wayne University College of Medicine, Detroit.

The relation of dietary protein to hemoglobin formation in the rat is being investigated. Animals at weaning (21 days) were fed a synthetic diet adequate except for a low level of protein of excellent quality (lactalbumin). Special attention was given to assure the daily consumption of an abundance of all the known vitamin factors.

At 100 days of age, the "low-protein" animals appeared in good condition, although increase in body weight had been almost entirely inhibited. Blood studies showed, however, the existence of a typical hypochromic anemia, characterized by a nearly normal red cell count, a low hemoglobin value, and an increased proportion of reticulocytes. Calorie control rats receiving exactly the same quantities of all of the dietary constituents except the amount of protein (increased at the expense

of carbohydrate) showed a normal blood picture. Furthermore, the feeding of an increased amount of protein (again at the expense of carbohydrate) with no increase in calories or inorganic matter, promptly corrected the anemia. Increasing the iron intake, on the other hand, had no effect. Thus, the anemia is clearly referable to the low protein intake.

Additional experiments designed to determine the possible effect of the administration of individual amino acids, including glycine, leucine, tryptophane, histidine, cystine, methionine, valine, glutamic acid, proline, phenyl alanine, tyrosine, and lysine, will be discussed.

*Carbohydrate combustion in man after oral versus intravenous administration of dextrose.* Thorne M. Carpenter and Howard F. Root, Nutrition Laboratory of the Carnegie Institution of Washington and Baker Clinic of the New England Deaconess Hospital, Boston.

In observations on certain diabetic subjects, there was no definite rise in respiratory quotient after intravenous injection of dextrose. As a control, comparison was made of the effects of oral and intravenous administration of dextrose with four normal men. The respiratory exchange was determined in three 10-minute periods with the men sitting, post-absorptive, and in nine 15-minute periods after dextrose. In one series of experiments, 50 gm. of dextrose in 350 cc. of water was taken orally. In another, 50 gm. of dextrose in 500 cc. of a normal saline solution was injected intravenously. After sugar was given, the respiratory quotient showed a definite rise and nearly the same course in both series. The oxygen consumption also increased in both series. The increases above the base lines in the calculated carbohydrate combustion ranged from 7.1 to 15.0 gm. during 2½ hours after oral ingestion and from 5.5 to 15.7 gm. after intravenous administration. The increases after oral ingestion averaged 1.6 gm. higher than those after intravenous introduction. The smallest difference was found with the subject showing the greatest increases above the base line. The increases in heat production ranged from 8.0 to 27.5 cals. after oral ingestion and from 6.8 to 18.4 cals. after intravenous injection. The average difference between the two methods was 5.0 cals. After intravenous injection, all subjects eliminated sugar in urine.

*Vitamin K.* E. A. Doisy (introduced by H. S. Mitchell), S. B. Binkley (by invitation), D. W. MacCorquodale (by invitation), R. W. McKee (by invitation), and S. A. Thayer (by invitation), Department of Biological Chemistry, St. Louis University School of Medicine, St. Louis.

Following the development of a quantitative procedure for the assay of vitamin K, the natural antihemorrhagic factors have been isolated from alfalfa and from putrefied sardine meal by a process in which the important feature was chromatographic adsorption on decalso and permutit. The former was called vitamin $K_1$ ($C_{31}H_{46}O_2$), and the latter, vitamin $K_2$ ($C_{41}H_{56}O_2$).

The oxidation of vitamin $K_1$ gave 2-methyl-1,4-naphthoquinone-3-acetic acid and a ketone which proved to be identical with the ketone from phytol. Synthesis of 2-methyl-3-phytyl-1,4-naphthoquinone gave a product which was identical with the natural vitamin $K_1$.

Degradation has given conclusive evidence that vitamin $K_2$ is also a 2,3 disubstituted 1,4-naphthoquinone. Ozonolysis of diacetyl dihydrovitamin $K_2$ with decom-

position of the ozonide with zinc has given the same ring compound, 1,4-diacetoxy-2-methyl-naphthalene-3-acetaldehyde, that was obtained from vitamin $K_1$. This clearly indicates that vitamin $K_2$ has the active 2-methyl-1,4-naphthoquinone structure and that it differs from vitamin $K_1$ only in the substituent in the 3 position.

Following our discovery of the nature of the ring structure of the natural vitamins, it was shown that several simple naphthoquinones possess antihemorrhagic properties. Moreover, two compounds which are closely related to the very active 2-methyl-1,4-naphthoquinone, i.e., 1,4-dihydroxy-2-methylnaphthalene and 4-amino-2-methyl-1-naphthol hydrochloride are approximately as potent. Due to their solubility in water these compounds are important for intravenous therapy.

*Comparative activities of certain antihemorrhagic quinones.* H. J. Almquist and A. A. Klose (by invitation), Division of Poultry Husbandry, College of Agriculture, University of California, Berkeley.

The authors have assayed by quantitative methods various quinones with antihemorrhagic activity in an effort to establish the comparative potencies of these compounds according to a common reference standard and assay methods. The methods involve no master curves or arbitrarily chosen values. Data have been obtained on vitamin $K_1$ (natural and synthetic), vitamin $K_2$ and other compounds that have been mentioned in the literature. 3-nitro-, 3-amino, 3-palmityl-, and 8-sulfonic acid derivatives of 2-methyl-1,4-naphthoquinone have been synthesized.

A comparison of similar compounds suggests that potency decreases as relative water solubility increases. 1,4 reductive acetylation decreases activity to from one-half to one-third of the original value. The activities of vitamins $K_1$ and $K_2$ are in direct proportion to their contents of the naphthoquinone nucleus. The long side chains of these vitamins are non-essential for potency and are probably split off in the metabolism of the vitamin. The antihemorrhagic potency of compounds appears to depend upon the presence of, or ready conversion to, the active configuration as present along the 1,2,3,4 positions of 2-methyl-1,4-naphthoquinone.

The potencies of vitamins $K_1$ and $K_2$ were found to be, respectively, 290 and 230 methyl naphthoquinone units per milligram.

*Biological synthesis of ascorbic acid.* H. E. Longenecker (by invitation) and C. G. King, Chemistry Department, University of Pittsburgh, Pittsburgh.

The occurrence of ascorbic acid in nearly all living cells, irrespective of nutrient requirement, provides an indication that the acid can be synthesized from other metabolites by a great many plants and animals. A number of compounds that stimulate synthesis and excretion in experimental animals have been identified. Comparative tests with different animals show wide variations in response to different agents. Some of the most active compounds are in common pharmacological and clinical use for other purposes, especially as antipyretics, analgesics and hypnotics. The response to specific stimulants can be very markedly influenced —essentially controlled—by the diets of experimental animals such as the rat.

*Further studies on the relationship of choline and betaine in the utilization of homocystine.* Vincent du Vigneaud, J. P. Chandler (by invitation), and A. W. Moyer (by invitation), Cornell University Medical College, New York.

In a previous investigation evidence was obtained that the presence of choline or betaine in the diet was necessary to enable homocystine to replace methionine in

the diet. It was therefore suggested that choline brought about the methylation of homocysteine to methionine and that the reaction might be reversible with methionine acting as a precursor of choline in the body in the sense of supplying necessary methyl groups. The present report deals with a closer examination of the relationship of choline and related substances to the utilization of homocystine.

Experiments have been carried out to ascertain whether choline would be effective by injection. The amounts required were relatively of the same order of magnitude as by mouth, indicating that the formation of methionine was not due to the action of intestinal bacteria.

A careful comparison of the effectiveness of choline and betaine was also made. By either route betaine showed a delayed and somewhat less efficient action than choline. This was particularly true of very young animals of 21 to 25 days of age.

An extended study of the relationship of structure of choline to the reaction in question will be presented. Studies are also under way in an attempt to show by direct proof the conversion of homocystine to methionine in the presence of choline in vivo and of the significance of the methyl group of methionine for the synthesis of choline.

*Observations on the relation of vitamin P to scurvy.* E. W. McHenry and H. M. Perry (by invitation), School of Hygiene, University of Toronto, Toronto.

The principal physiological effect of vitamin P was described by Szent-Györgyi as the maintenance of resistance of capillary walls and the consequent prevention of hemorrhage. Several workers, notably Zilva, have failed to substantiate the claims for vitamin P but Scarborough has recently provided evidence for the existence of such a factor. Using guinea pigs, in which hemorrhage is a marked feature of scurvy, we have studied the action of purified preparations of vitamin P. These have had no effect in preventing increased capillary fragility, which is produced by a lack of ascorbic acid and promptly cured by that substance. Paired feeding experiments show that inanition is not a factor. In an attempt to verify these observations in humans we have employed a simple, standardized test for capillary fragility. In fifty-eight normal persons the results over an extended period have been so variable that no significance could be attached to them. This is in agreement with the work of Weld. It is concluded that deficiency of vitamin P is not a factor in producing hemorrhages in scorbutic guinea pigs, that a deficiency of ascorbic acid is alone responsible, and that a capillary fragility test is not a reliable indication of ascorbic acid deficiency in humans.

*Unavailable carbohydrate balances of children.* F. C. Hummel (by invitation), M. L. Shepherd (by invitation), and I. G. Macy, Research Laboratory, Children's Fund of Michigan, Detroit.

Unavailable carbohydrate balances for ten normal children, four girls and six boys, ages 5 to 8 years demonstrate the variations in intake, physiological response and carbohydrate disappearance in the alimentary canal which occur consequent to a uniform daily diet composed of sufficient nutrients to meet the individual's requirements of growth, activity and well being.

During the observation of 220 consecutive days (forty-four 5-day balances) for each child the average total fiber consumed by the subjects per day varied from

5.55 to 6.49 gm. of which 2.08 (SD = 0.07) to 2.42 (SD = 0.26) gm. were cellulose and 2.00 (SD = 0.19) to 2.51 (SD = 0.16) gm. hemicellulose. The consequent laxation rate varied from 1.1 (SD = 0.09) to 2.5 (SD = 0.70) and the disappearance of cellulose from 1.21 (SD = 0.42) to 1.95 (SD = 0.2) gm. and of hemicellulose 1.09 (SD = 0.33) to 1.54 (SD = 0.27) gm. Individual differences exist among children in their ability to break down cellulose and hemicellulose in their respective digestive tracts. In some cases as much as 80% of cellulose is destroyed in its passage through the tract in contrast to low values of 53% while hemicellulose is somewhat lower and less variable in its decomposition (49 to 61%).

The above results will be considered in relation to the individual's gastrointestinal motility, daily fecal excretion (wet weight, total solids, nitrogen and fat content) and other pertinent physiological findings.

*The rate of digestion of some natural and synthetic fats in the rat.* H. J. Deuel, Jr., and L. F. Hallman (by invitation), Department of Biochemistry, University of Southern California Medical School, Los Angeles.

Certain natural fats were fed to fasting rats in amounts of 1 cc. and the amount of undigested fat remaining in the gut was determined at 3, 4½, and 6 hours thereafter by a procedure described earlier.[1] No differences were noted in the rate of digestion of a hydrogenated cottonseed fat, butter, coconut oil or wintered cottonseed oil. Rape seed oil on the other hand was absorbed more slowly. Hydrogenated cottonseed fat and rape seed oil were absorbed more rapidly when fed in higher doses.

In the experiments with synthetic fats, it was found that best recoveries were obtained when the gut was flushed with diethyl ether alone. The fats were administered in doses of 300 mg. per 100 sq.cm. and the animals killed after 3 hours. The fats having even-chain fatty acids (triacetin, tributyrin, tricaproin, and tricaprylin) were absorbed at about the rate of natural fats (60–50 mg. per 100 sq.cm. per hour) while the fats having an odd number of carbon atoms (tripropionin, trivalerin, and triheptylin) disappeared at approximately one-half the rate of the even-chain fats.

[1] Deuel, H. J., Jr., Hallman, L. F., and Quon, S., J. Biol. Chem., vol. 128, XIX (1939).

*Muscular dystrophy in rabbits and the autoxidation of animal fats.* H. A. Mattill, Biochemical Laboratory, State University of Iowa, Iowa City.

On a synthetic diet containing lard and cod liver oil and otherwise adequate except for the absence of vitamin E, growth ceases in young rabbits (700–900 gm.) after 10 to 20 days, and dystrophy soon appears. Such diets supplemented by 3–5% of wheat germ oil usually allow normal growth and the appearance of dystrophy is postponed. On standing the vitamin E content of such diets gradually declines. This loss of vitamin E may be delayed by the use of appropriate stabilizers against oxidative rancidity.

The water-soluble factor is apparently supplied in adequate amounts by 5% of yeast in the diet. Wilson's defatted liver powder contains no vitamin E. The water-soluble factor in yeast is much less vulnerable than vitamin E when in contact with autoxidizing fats. α-Tocopherol acetate[1] is much less effective when given parenterally or subcutaneously than when given by mouth.

[1] Hoffmann-La Roche.

*Relation of perosis to unrecognized vitamins.* A. G. Hogan, L. R. Richardson (by invitation), and Homer Patrick (by invitation), Department of Agricultural Chemistry, University of Missouri, Columbia.

It is now well established that the perosis which develops in chicks on certain rations can be prevented by including additional manganese in the ration. During the course of our efforts to develop adequate simplified rations for the chick, perosis was occasionally encountered even though the diets contained much more manganese than is commonly recommended as a preventative. This observation suggested that an organic factor, as well as manganese, is concerned in the syndrome and an attempt was made to prepare vitamin carriers that do not contain it. Dried liver was extracted first with hot alcohol and then with hot water. The alcohol extract contains all of the substances that prevent perosis. The water extract and the liver residue contain little or none, and they are included in the perosis producing ration. Thiamin, riboflavin, and vitamins A and D are also included, and the ration is improved by adding $B_6$. Eighty-eight chicks, from ten different hatches, have received this ration and 100% developed marked cases of perosis. Two hundred and forty-eight chicks have received a similar ration, except that it contained the alcohol extract, and none developed perosis. It is concluded that the chick requires a previously unrecognized vitamin, provisionally designated as $B_p$.

*The effect of nicotinic acid and coramine on experimental blacktongue and human pellagra.* D. T. Smith (by invitation), J. M. Ruffin (by invitation), and S. G. Smith, Department of Medicine, Duke University School of Medicine, Durham.

A study of over 400 cases of pellagra indicates that the cardinal symptoms are anorexia, dermatitis, glossitis, diarrhea and dementia. Pellagrins may have multiple secondary deficiencies especially among members of the B complex, e.g. $B_1$, riboflavin and $B_6$. The administration of nicotinic acid or coramine cures the primary symptoms, and usually the secondary ones as well, probably by stimulating the ingestion and assimilation of more food. However, severe secondary deficiencies must be corrected before the patient will respond properly to nicotinic acid.

In dogs with experimental blacktongue the daily minimal curative dose of nicotinic acid is 0.5 mg. per kilogram. To obtain the same effects with coramine 7.25 mg. per kilogram is required. Multiples of the minimal dose of both drugs give no more rapid improvement and are not stored by the body.

When dogs with experimental blacktongue develop secondary deficiencies of $B_1$ and riboflavin they fail to gain weight with nicotinic acid therapy until these deficiencies are corrected.

Solutions of nicotinic acid may be sterilized by boiling or autoclaving without loss of potency and may be administered orally, intramuscularly, or intravenously. Doses three times the minimal dog dose (1.5 mg. per kilogram) or approximately 100 mg. per day produce prompt and dramatic cures in the most severe cases of pellagra. Twice the minimal dog dose of coramine or approximately 750 mg. per day has also given entirely satisfactory results.

## ABSTRACTS OF PAPERS READ BY TITLE

*Spectroscopic studies of fatty acids.* R. H. Barnes (by invitation), J. P. Kass (by invitation), E. S. Miller (by invitation), and G. O. Burr, Departments of Physiology and Botany, University of Minnesota, St. Paul.

Recently physiological studies have been aided by the use of tagged or labelled molecules. In lipid metabolism radioactive phosphorus has been used. Iodized fatty acids, highly unsaturated acids, elaidic acid, acids containing deuterium, and spectroscopically active acids will label both phospholipids and neutral fats. Spectroscopically active acids have proved especially sensitive indicators because of the high precision of the spectroscope and the small amounts required.

Normal tissue fats have very low absorptive values at 2300 A.U. (lard = about 3). Corn oil can be activated to a value of 400, which is so high that a trace of it can be detected in the normal fat. The activated fatty acids are usually administered as methyl or ethyl esters. They are not at all toxic and are apparently normally metabolized.

Recent studies have given very regular curves for rates of absorption and transport to the liver. In the intestinal mucosa the neutral fats show maximum spectral absorption within ½ hour, while the phospholipids give a smooth rising curve which is approaching a limit of tagged acid interchange only after 14 hours. This and other experimental data are shown and discussed.

The method of activation of fatty acids has been made quantitative so that it is possible to analyze an oil accurately by this procedure. The method of analysis is given in detail.

*A deficiency disease in chicks prevented by dl-alpha tocopherol.* H. R. Bird (by invitation), and T. G. Culton (by invitation), (introduced by O. L. Kline), Department of Poultry Husbandry, University of Maryland, College Park.

Chicks were fed from hatching time a diet of dried skim milk 54%, dextrinized starch 44%, ground limestone 1% and NaCl 1% with the following additions of mineral salts: ferric citrate 0.12%, $CuSO_4 \cdot 5\,H_2O$ 0.0012% and $MnSO_4 \cdot 4\,H_2O$ 0.012%. Cod liver oil was administered by pipette thrice weekly. When certain samples of dried skim milk were fed as a part of this diet there was a high incidence of generalized edema in chicks 3 to 8 weeks of age, followed by death in all cases. The most consistent post mortem finding was a very great distension of heart and pericardium, the latter being filled with exudate. In most cases there was extreme ascites and subcutaneous edema, and frequently edema of the brain and lungs, extreme coronary and intestinal hyperemia, and deposition of urates in ureters and kidneys.

This condition was effectively prevented, first, by inclusion of 3% of dehydrated grass in the diet, and later by the administration in cod liver oil of synthetic dl-alpha tocopherol at a dosage approximating 7.5 micrograms per gram live weight per day. The tocopherol was kindly furnished by Merck and Co. and its use was suggested by Dam's[1] report of its effectiveness in preventing the "alimentary exudative diathesis" which he observed in young chicks.

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[1] Dam, H., Nature, vol. 143, p. 810 (1939).

*The effects of alimentary and adrenalin hypergiycemia on total oxidation of carbohydrate in normal humans.* J. W. Conn (by invitation), E. S. Conn (by invitation), and M. W. Johnston, Nutrition Laboratory, Department of Internal Medicine, University of Michigan Medical School, Ann Arbor.

For 6 to 8 weeks, three normal young men were fed constant maintenance diets. Activity from day to day was constant. Twenty-one 4-hour experimental periods of continuous indirect calorimetry by the open-circuit method were done under conditions of fasting, glucose orally, adrenalin subcutaneously and the latter two simultaneously. Under the same conditions blood sugar curves were obtained.

*Results and conclusions*

The blood sugar level does not control total oxidation of glucose in normal humans. After adrenalin with levels reaching 200 mg. %, less glucose was oxidized than in the fasting state at levels of 80 mg. %. Levels of 350 mg. % produced by adrenalin plus glucose resulted in no greater oxidation of glucose than levels of 170 mg. % produced by glucose alone. With the same degree of hyperglycemia, over twice as much glucose was oxidized when the hyperglycemia was produced by ingested glucose as when produced by adrenalin.

Under all conditions studied, oxidation of glucose, when influenced by adrenalin, was decreased, despite the plethora of glucose in the circulating blood.

The conflicting results of others, using hepatectomy, are reconcilable if one assigns to the liver of the normal intact animal the function of initiating the mechanism which determines how much of the total heat produced will be derived from carbohydrate.

The liver, as the immediate receptor of the dietary or as influenced by abnormalities of carbohydrate metabolism, regulates carbohydrate oxidation in the animal body.

*A study of vitamin C nutrition in a group of school children.* Marian M. Crane (by invitation), P. W. Woods (by invitation), E. M. Waters (by invitation), and E. F. Murphy (by invitation), Children's Bureau, U. S. Department of Labor, Washington, and Maine State Bureau of Health and Maine Agricultural Experiment Station, Orono.

The state of nutrition with respect to vitamin C in a group of eighty-six rural Maine grade-school children was studied in the autumn (1938) and again in the spring (1939). Ascorbic acid in the blood plasma was determined by a modification of Ingalls' technique. Approximately 28% of the children had low values (less than 0.40 mg. per cent) in both autumn and spring, about 27% had intermediate values (0.40–0.79 mg. per cent) in autumn and low values in spring. Only two children had values consistently high enough to be considered evidence of adequate vitamin-C intake (0.80 mg. per cent or above) at both examinations.

Urinary tests of vitamin-C tolerance in forty-nine children generally supported the validity of plasma ascorbic acid determinations as evidence of the state of vitamin-C nutrition.

Examination of the eighty-six children by a dentist showed that approximately 29% had inflamed gums both in autumn and spring, and about 51% (an additional

22%) had inflamed gums at the spring examination. The association between mouth findings and plasma ascorbic acid values and the results of vitamin-C therapy administered to forty-one children with inflamed gums indicate that vitamin-C undernutrition is, in all probability, a factor in the causation of the inflammation.

The classical picture of scurvy was not observed in any of the children studied.

Study of the diets of a number of the children showed that probably not more than one child in seven was eating any food that is a good source of vitamin C as often as once a day.

*Hemorrhagic adrenal necrosis in rats on deficient diets.* F. S. Daft (by invitation), and W. H. Sebrell, National Institute of Health, Washington.

Rats on a diet deficient in the vitamin B complex were given supplements of nicotinic acid, choline, $B_1$, riboflavin and vitamin $B_6$ in various combinations. In many of the animals extensive hemorrhagic necrosis of the adrenal glands was found at death. When crystalline vitamin $B_6$ was used the lesions were seen earlier on a larger percentage of the animals. This increased incidence may be explained on the basis of the accentuation of the symptoms of one deficiency by the administration of another missing vitamin. The lesions were not seen when a crude liver or rice polishings extract was added in sufficient amounts. The chemical properties of the factor preventing the hemorrhagic adrenal necrosis and its identity or non-identity with known and postulated water soluble vitamins will be discussed.

*Studies of the vitamin B-complex with chicks.* T. H. Jukes, Division of Poultry Husbandry, University of California, Davis.

Experiments with a diet deficient in vitamin $B_6$ indicated that chicks require about 3 micrograms of this factor per gram of diet. The corresponding requirement for thiamin is about 1.5 micrograms; for riboflavin, 2.7 micrograms; and for pantothenic acid, 14 micrograms. An unknown water-soluble fraction is also needed. This was investigated with chicks on a simplified diet, supplemented with synthetic thiamin and riboflavin, and with rice bran filtrate to supply pantothenic acid. A fraction promoting growth and permitting survival was found present in corn and in extracts of yeast, alfalfa meal, liver and grass. The factor was largely destroyed by autoclaving the yeast. The factor was precipitated from aqueous solution by addition of alcohol or acetone. Attempts to fractionate yeast extracts resulted in large losses. Yeast fuller's earth eluates, potent sources of factor 2 for rats, produced very little response from the chicks. Additions of nicotinic acid or synthetic vitamin $B_6$ to the diet were ineffective. Addition of further amounts of thiamin improved growth and permitted survival; but when riboflavin and nicotinic acid were added in addition to thiamin, no improvement over the basal diet was noted.

The dietary requirement for the known B-factors is compared with the quantitative distribution of various members of the vitamin B-complex in certain foods, and the question of balancing a diet with respect to the individual B-factors is discussed.

*The anti-cataractogenic action of certain nitrogenous factors.* H. S. Mitchell, G. M. Cook (by invitation), and M. D. Henderson (by invitation), Nutrition Laboratory, Massachusetts State College, Amherst.

It was reported earlier that inadequate protein (5%) aggravated and that high-protein (45%) inhibited the development of cataract in rats on a 25% galactose ration. Having eliminated known vitamin entities as protective agents, the search has been for a specific nitrogenous factor.

Casein hydrolysate gave the same protection as an equivalent amount (15%) of commercial casein. Cystine and methionine gave only slight and inconsistent protection. Moreover when the sulfhydryl amino acids were made less available by feeding 100 mg. of iodoacetic acid per 10 gm. of casein, growth was retarded but cataract was not hastened. Urea at 3, 5 and 10% levels gave less protection than an equivalent amount of nitrogen fed as protein but more than the 5% casein basal ration. Choline was studied by feeding 1, 2, 4 and 8% in a 5% casein ration. Growth was progressively poorer the higher the level of choline fed and it exerted no protection against cataract.

When casein, deaminized by treatment with nitrous acid, furnished two-thirds of the 15% protein in the ration, growth was delayed but there was more protection against cataract than with commercial casein. On the other hand the prolonged exposure of certain proteins to dry heat appears to destroy the protective action in some more than in others and not in proportion to the growth-promoting power. Work on the identification of the protective factor is now in progress.

*Anti-grey hair vitamin deficiency in dogs and silver foxes.* A. F. Morgan, Department of Home Economics, University of California, Berkeley.

Eighteen young dogs from five litters and six young foxes of three litters were placed at 5 to 8 weeks of age on a purified diet of washed casein, cornstarch, sucrose, Crisco and salt mixture. They received separately daily additions of cod liver oil reinforced with carotene, crystalline thiamin chloride, riboflavin, vitamin $B_6$ concentrate or crystalline $B_6$. Some received in addition nicotinic acid and/or a yeast or rice bran filtrate concentrate.

Those which received all the supplements grew normally, matured sexually and retained their coat color. Those without either nicotinic acid or the filtrate factor grew fairly normally but after 3 to 4 months their hair showed definite and progressive depigmentation beginning at the follicles.

The animals which received nicotinic acid but no filtrate factor developed the depigmentation earlier and manifested bloody diarrhea, loss of appetite, cachexia and death within 3 months. If the missing factor was given, immediate restoration of appetite, growth and repigmentation of hair and skin occurred. One of the anti-grey factor-deficient foxes died suddenly after 6 weeks and the two remaining lost their hair but on administration of the missing factor grew a new coat of white instead of black fur.

When nicotinic acid only was withheld the dogs died after 3 to 6 months with inflamed mouths, bloody diarrhea and usually convulsions. Fading of the hair did not occur.

Apparently the two factors, nicotinic acid and the anti-grey filtrate factor are interrelated and to some extent antagonistic in function. Low urine volumes and

low blood chlorides were observed in the filtrate-factor deficient but not in the nicotinic acid deficient dogs.

*Possible significance of fecal concentrations of the factor protective against egg white injury.* H. T. Parsons, J. Gardner (by invitation), and C. T. Walliker (by invitation), Department of Home Economics, University of Wisconsin, Madison.

Feces produced on a series of raw egg white rations are non-potent when fed raw to test rats on raw egg white rations, but are highly potent fed in like manner after thorough, moist heating. Apparently mild hydrolysis in cooking the feces frees some protective factor held in non-absorbable form by some substance.

Feces produced on rations differing from the first series only in that the raw egg white has been replaced by either cooked egg white or raw egg white after the removal of a highly injurious fraction during dialysis, possess after cooking either no demonstrable potency or much less than that in feces produced on raw egg white rations. It is thought that fecal bacteria are not responsible for the difference in the effects in the two series inasmuch as the rations containing raw egg white are so closely similar. From these observations it is suggested as a tentative hypothesis that raw egg white derives its essential capacity to produce a pathological condition, not from its own possible lack of the protective factor in available form nor from the presence of a hypothetical antienzyme but from its characteristic in the digestive tract of combining with and holding in an unabsorbable form, the protective factor which originated either from the diet alone or, also, from an excretion into the digestive tract. The "curative" quality of cooked egg white probably depends on the destruction of such a capacity rather than on the formation of protective factor in the egg white itself by cooking.

*Reproduction on "adequate" diets containing meat.* P. P. Swanson and P. M. Nelson, Nutrition Laboratory of the Foods and Nutrition Department, Iowa State College, Ames.

In an experiment designed to study the nutritive value of dried autoclaved pork in a diet fortified with all known dietary essentials, extinction of the species occurs in the second generation when the rat is used as the experimental animal. Physiological disturbances causing the phenomenon are: acute and fatal pregnancy disease, either birth of non-viable young or failure of establishment of mammary function, and complete sterility in the second generation.

The correlation of the diet to the reproductive upset has been studied extensively. First, balance studies show that autoclaving does not reduce the biological value of the pork muscle. Second, peroxide values indicate that rancid fat is not the dietary offender. In this connection, assay proves that the ration is adequate in essentials possibly affected by rancidity (A and E). Third, the addition of B complex, liver extract, E, lactoflavin, K, choline, or lecithin reduces the efficiency of the ration. Fourth, the diet is markedly improved by the substitution of beef for pork in the formula or by supplementation with liver or a certain lipocaic preparation.

The liver addition prevents the degeneration of hepatic tissue associated with pregnancy disease, reduces the per cent of individual feti found resorbing at

autopsy prior to the birth of the second litter and permits normal birth and suckling of litters. The diet, therefore, is probably deficient in some unidentified factor or factors.

*Availability of phosphorus in hays.* D. E. Williams (by invitation), F. L. MacLeod, E. Morrell (by invitation), and H. R. Duncan (by invitation), Agricultural Experiment Station, University of Tennessee, Knoxville.

Evidence for difference in availability of phosphorus in low phosphorus hay versus high phosphorus hay of the same type was found with white rats. Hays fed were lespedeza sericea, alfalfa, soybean hay, and red clover. Nutritive quality of the diets and food consumptions of comparable animals were kept as uniform as possible. In the control diet, the phosphorus was supplied from a readily assimilable salt mixture in an amount approximately minimal for normal growth. In the hay diets, the same amount of phosphorus was supplied one-half by salt mixture and one-half by a large amount of low phosphorus hay in one case and by a smaller amount of high phosphorus hay in the other.

The animals on the low phosphorus hays were less thrifty than the controls or the animals fed the high phosphorus hay diets according to various criteria indicating rate of growth and phosphorus retention. Animals on the low phosphorus hay eliminated the largest amounts of feces.

Similar experiments, now under way, in which calves replaced rats apparently confirm the rat experiments. During 6 months' experimentation average gains in growth expressed by body weight in pounds, height and heart girth in inches, respectively, are for control calves, 139, 4.70, 5.71; for calves on low phosphorus red clover, 49, 1.71, 1.59; for calves on high phosphorus red clover 134, 3.87, 5.37.

## ABSTRACTS OF SYMPOSIUM PAPERS

*The problem of promoting better human nutrition.* E. V. McCollum, Department of Biochemistry, School of Hygiene and Public Health, The Johns Hopkins University, Baltimore.

As a result of research during the past 40 years the importance of an optimum diet for the promotion of health has become a scientifically recognized fact. Knowledge is available for providing diets of high quality. The modern techniques for detecting nutritional deficiency states have brought to light the widespread existence of malnutrition of several types. Upon nutritional experts rests the duty of actively putting into practical use the newer knowledge of nutrition.

The world-wide basis for malnutrition is an economic one, but ignorance, indifference, and misinformation are also concerned. The immediate problem is to make the higher quality foods economically available to the families on low income. This may be accomplished in part if the families produce more of their own garden crops as was done so successfully during the first World War. Such supervised projects should be encouraged not only for nutritional but also for recreational advantages.

Many self-appointed nutritional advisors contribute extensively to our stock of misinformation. Due to this, malnutrition is not limited to those in the lower

income brackets but exists also in well-to-do families. It is by educating the public to utilize a well-balanced diet, rather than a poor one supplemented by commercial concentrates of minerals and vitamins, that the nutritionist's aim, the preservation of health, may be forwarded.

*The assessment of the nutrition of populations.* John B. Youmans, Vanderbilt University, Nashville, Tenn.

The growing public health interest in nutrition and recognition of the importance of mild or latent dietary deficiencies, particularly of so-called protective substances such as vitamins requires the development of improved methods of assessing the nutrition of populations. Older and traditional methods, concerned in the main with energy yielding principles and using only records of food consumption, rather gross physical measurements and the detection of obvious nutritional disease, will not suffice. A satisfactory method will include an individual record of food consumption, full medical history and examination by competent physicians and suitable laboratory tests for mild or early deficiencies insofar as they can be detected by this means. Also, it will permit the examination of a group sufficiently large to satisfy statistical requirements and yet allow careful work. Such a study, which includes, besides the record of food consumption and medical history and examination, tests for deficiency of vitamins A, $B_1$, C, and D, nicotinic acid, protein, iron and calcium, is described. An impression of some of the early results is given.

*Dietary levels in the United States.* Hazel K Stiebeling, Bureau of Home Economics, U. S. Department of Agriculture, Washington, D. C.

As incomes rise, average per capita purchases of the major food groups by nonfarm families rise unequally. Relative increases are greatest for fruits, dairy products, meats, eggs, and succulent vegetables, and least for grain products and fats other than butter. The nutritive values of the diets of different income groups differ least with respect to calories, and most with respect to calcium and vitamins A, C, and riboflavin. Although average figures on nutritive value of diets of groups of families may exceed an arbitrary definition of "poor," the classification of diets, family by family, usually indicates that a fairly large proportion fall in the "poor" class. To achieve adequate diets many families need increased purchasing power, as well as greater information and skill in getting good value for their food expenditures; others spend enough to buy good diets but fail to acquire them. Of the latter, some may fail to appreciate the importance of well-balanced and generous diets; others appreciating it, lack the necessary knowledge and buying skills.

*Pellagra and associated deficiency diseases as a medical and public health problem.* Tom D. Spies, University of Cincinnati, School of Medicine.

Modern nutrition has made us aware of the requirement of the body for minerals, vitamins, and other dietary essentials. Analysis of our own studies and surveys indicates a widespread deficiency of the essential vitamins and minerals in a large group of the population. It is extremely important that the knowledge gathered in regard to the development, diagnosis, and treatment of the various deficiency

diseases and the subclinical states be applied toward initiating corrective measures, thus saving years of ill health for many people. With these persons in mind, the following rather arbitrary suggestions are offered for consideration. The population as a whole can be aided by restoring certain foods to their natural vitamin and mineral content. No restored food should exceed in any respect the highest potency of foods within its class, and there should be a proper balance between the various nutrients. Those persons who can should be urged to eat an optimum diet. The diet of many persons which is necessarily restricted because of poverty or ignorance can be improved by the addition of certain inexpensive natural foodstuffs. For some time, fortification of food will be essential for a large group; each fortified food should stand on its own merit and careful study in each instance should determine the desirable level of the added constituent. It appears that restoration or fortification can be accomplished best in some instances by the addition of synthetic substances, and in others by concentrates of natural foodstuffs. In the practice of medicine, judicious use of synthetic materials or concentrates is valuable, indeed is often essential to save life.

It is obvious that neglect will not solve these problems. Although our present knowledge is crude and scant, as measured by that which will come from scientific research, we should direct efforts toward obtaining important information leading to effective control.

# INDEX TO SUPPLEMENT


ABBOTT, O. D., C. F. AHMANN AND M. R. OVERSTREET. Human nutritional anemia in Florida ..... 9
Abstracts of papers ..... 7, 15, 20
Acid, ascorbic, biological synthesis of 11
Acid, citric, and food citrate in infants, metabolism of ..... 8
Acid, nicotinic, and coramine, effect of, on experimental blacktongue and human pellagra ..... 14
Acid, pantothenic, and its nutritional significance ..... 7
Acids, fatty, spectroscopic studies of 15
Acids, pyrazine and quinolinic, biological activity of ..... 8
Adrenal necrosis, hemorrhagic, in rats on deficient diets ..... 17
Adrenalin and alimentary, hyperglycemia, effects of, on total oxidation of carbohydrate in normal humans ..... 16
AHMANN, C. F. See Abbott, O. D. ... 9
Alimentary and adrenal hyperglycemia, effects of, on total oxidation of carbohydrate in normal humans 16
ALMQUIST, H. J., AND A. A. KLOSE. Comparative activities of certain antihemorrhagic quinones ..... 11
American Institute of Nutrition, proceedings of seventh annual meeting 1
Anemia, human nutritional, in Florida 9
Anti-cataractogenic action of certain nitrogenous factors ..... 18
Anti-grey hair vitamin deficiency in dogs and silver foxes ..... 18
Antihemorrhagic quinones, certain, comparative activities of ..... 11
ARMSTRONG, W. See Outhouse, J. P. 8
Ascorbic acid, biological synthesis of 11
Assessment of the nutrition of populations ..... 21
Autoxidation of animal fats, muscular dystrophy in rabbits and ..... 13
Availability of phosphorus in hays ... 20

BARNES, D. J. See Smith, A. H. .. 8
BARNES, R. H., J. P. KASS, E. S. MILLER AND G. O. BURR. Spectroscopic studies on fatty acids .... 15
Betaine and choline in the utilization of homocystine, further studies on the relationship of ..... 11
BINKLEY, S. B. See Doisy, E. A. .... 10
Biological activity of pyrazine acids and quinolinic acid ..... 8
Biological synthesis of ascorbic acid .. 11
BIRD, H. R., AND T. G. CULTON. A deficiency disease in chicks prevented by dl-alpha tocopherol ..... 15
Blacktongue, experimental, and human pellagra, effect of nicotinic acid and coramine on ..... 14
BREITER, H. See Outhouse, J. P. 8
BURR, G. O. See Barnes, R. H. ..... 15
Business session, American Institute of Nutrition ..... 1

CALCIUM, dietary, man's utilization of ..... 8
Carbohydrate balances, unavailable, of children ..... 12
Carbohydrate combustion in man after oral versus intravenous administration of dextrose ..... 10
Carbohydrate in normal humans, effects of alimentary and adrenalin hyperglycemia on total oxidation of ..... 16
CARPENTER, T. M., AND H. F. ROOT. Carbohydrate combustion in man after oral versus intravenous administration of dextrose ..... 10
CHANDLER, J. P. See du Vigneaud, Vincent ..... 11
Chicks, deficiency disease in, prevented by dl-alpha tocopherol ..... 15
Chicks, studies of the vitamin B-complex with ..... 17
Children, unavailable carbohydrate balances of ..... 12
Choline and betaine in the utilization of homocystine, further studies on the relationship of ..... 11
Citrate, food, and citric acid in infants, metabolism of ..... 8
Citric acid and food citrate in infants, metabolism of ..... 8
Committee on Mead Johnson award .. 5
Comparative activities of certain antihemorrhagic quinones ..... 11
CONN, E. S. See Conn J. W. ..... 16
CONN, J. W., E. S. CONN AND M. W. JOHNSTON. The effects of alimentary and adrenalin hyperglycemia on total oxidation of carbohydrate in normal humans ..... 16
COOK, G. M. See Mitchell, H. S. .... 18
Coramine and nicotinic acid, effect of, on experimental blacktongue and human pellagra ..... 14
Council meeting, March 12, 1940 ... 1
CRANE, MARIAN M., P. W. WOODS, E. M. WATERS AND E. F. MURPHY. A study of vitamin C nutrition in a group of school children ..... 16
CULTON, T. G. See Bird, H. R. .... 15

DAFT, F. S., AND W. H. SEBRELL. Hemorrhagic adrenal necrosis in rats on deficient diets ..... 17
DANN, W. J., H. I. KORN AND P. HANDLER. The biological activity of pyrazine acids and quinolinic acid ..... 8
Deficiency diseases, associated, and pellagra, as a medical and public health problem ..... 21
Deficiency disease in chicks prevented by dl-Alpha tocopherol ..... 15
Deficiency in man, experimental vitamin $B_1$ ..... 7
Deficient diets, hemorrhagic adrenal necrosis in rats on ..... 17

DEUEL, H. J., JR., AND L. F. HALLMAN. The rate of digestion of some natural and synthetic fats in the rat ..... 13
Dextrose, carbohydrate combustion in man after oral versus intravenous administration of ..... 10
Dietary levels in the United States 21
Digestion of some natural and synthetic fats in the rat, rate of ..... 13
dl-Alpha tocopherol, deficiency disease in chicks prevented by ..... 15
Dogs and silver foxes, anti-grey hair vitamin deficiency in ..... 18
DOISY, E. A., S. B. BINKLEY, D. W. MACCORQUODALE, R. W. MCKEE AND S. A. THAYER. Vitamin K 10
DUNCAN, H. R. See Williams, D. E. .. 20
DU VIGNEAUD, VINCENT, J. P. CHANDLER AND A. W. MOYER. Further studies on the relationship of choline and betaine in the utilization of homocystine ..... 11
Dystrophy, muscular, in rabbits and the autoxidation of animal fats .... 13

EDITOR of The Journal of Nutrition, report of ..... 6
Editorial Board, March 13, 1940 ... 5
Effect of nicotinic acid and coramine on experimental blacktongue and human pellagra ..... 14
Effects of alimentary and adrenalin hyperglycemia on total oxidation of carbohydrate in normal humans 16
Egg white injury, possible significance of fecal concentrations of the factor protective against ... 13
Election of officers for 1940–1941 ... 3
Experimental vitamin $B_1$ deficiency in man ..... 7

FATS, animal, muscular dystrophy in rabbits and the autoxidation of 13
Fats, some natural and synthetic, in the rat, rate of digestion of ..... 12
Fatty acids, spectroscopic studies of 15
Fecal concentrations of the factor protective against egg white injury, possible significance of ..... 1:
Foxes, silver, and dogs, anti-grey hair vitamin deficiency in ..... 18
Further studies on the relationship of choline and betaine in the utilization of homocystine ..... 11

GARDNER, J. See Parsons, H. T... 19

HALLMAN, L. F. See Deuel, H. J., Jr. ..... 13
HANDLER, P. See Dann, W. J. ..... 8
Hays, availability of phosphorus in ... 20
Hemoglobin formation in the rat, relation of dietary protein to ..... 9
Hemorrhagic adrenal necrosis in rats on deficient diets ..... 17
HENDERSON, M. D. See Mitchell, H. S. 18
HOGAN, A. G., L. R. RICHARDSON AND H. PATRICK. Relation of perosis to unrecognized vitamins ..... 14
Homocystine, further studies on the relationship of choline and betaine in the utilization of ..... 11
Human nutritional anemia in Florida 9
Humans, normal, effects of alimentary and adrenalin hyperglycemia on total oxidation of carbohydrate in 16
HUMMEL, F. C., M. L. SHEPHERD AND J. G. MACY. Unavailabie carbohydrate balances of children ..... 12
Hyperglycemia, alimentary and adrenalin, effects of, on total oxidation of carbohydrate in normal humans ..... 16

INFANTS, metabolism of citric acid and of food citrate in ..... 8
Intravenous versus oral administration of dextrose, carbohydrate combustion in man after ..... 10

JOHNSTON, M. W. See Conn, J. W. 16
JUKES, T. H. Studies of the vitamin B-complex with chicks ..... 17

KASS, J. P. See Barnes, R. H. ... 15
KING, C. G. See Longenecker, H. E. 11
KLOSE, A. A. See Almquist, H. J. .. 11
KOHN, H. I. See Dann, W. J. ..... 8

LONGENECKER, H. E., AND C. G. KING. Biological synthesis of ascorbic acid ..... 11

MCCOLLUM, E. V. The problem of promoting better human nutrition 20
MCHENRY, E. W., AND H. M. PERRY. Observations on the relation of vitamin P to scurvy ..... 12
MCKEE, R. W. See Doisy, E. A. ... 10
MCKEY, B. See Outhouse, J. P. .. 8
MACCORQUODALE, D. W. See Doisy, E. A. ..... 10
MACLEOD, F. M. See Williams, D. E. 20
MACY, I. G. See Hummel, F. C. ... 12
Man, carbohydrate combustion in, after oral versus intravenous administration of dextrose ..... 10
Man, experimental vitamin $B_1$ deficiency in ..... 7
Man's utilization of dietary calcium 8
MASON, H. L. See Williams, R. D. .. 7
MATTILL, H. A. Muscular dystrophy in rabbits and the autoxidation of animal fats ..... 13
Mead Johnson Award for Research on vitamin B complex, report for the committee on ..... 2
Meat, reproduction of "adequate" diets containing ..... 19
Members of committee for Mead Johnson award ..... 5
Metabolism of citric acid and of food citrate in infants ..... 8
MEYER, C. E. See Smith, A. H. ..... 8
MILLER, E. S. See Barnes, R. H. ... 15
MILLS, R. See Outhouse, J. P. ..... 8
MITCHELL, H. H. See Outhouse, J. P. 8
MITCHELL, H. S., G. M. COOK AND M. D. HENDERSON. The anticataractogenic action of certain nitrogenous factors ..... 18
MORGAN, A. F. Anti-grey hair vitamin deficiency in dogs and silver foxes ..... 18
MORRELL, E. See Williams, D. E. ... 20
MOYER, A. W. See du Vigneaud, Vincent ..... 11
MURPHY, E. F. See Crane, Marian M. 16
Muscular dystrophy in rabbits and the autoxidation of animal fats .... 13

NECROSIS, hemorrhagic adrenal, in rats on deficient diets ..... 17
NELSON, P. M. See Swanson, P. P. 19
New members elected March 13, 1940 4
Nicotinic acid and coramine, effect of, on experimental blacktongue and human pellagra ..... 14
Nitrogenous factors, certain, anti-cataractogenic action of ..... 18
Nominating committee for 1940–1941 4
Nutrition, better human, problem of promoting ..... 20
Nutrition of populations, assessment of 21

OBSERVATIONS on the relation of vitamin P to scurvy ..... 12
Oral versus intravenous administration of dextrose, carbohydrate combustion in man after ..... 10
ORTEN, A. U., AND J. M. ORTEN. The relation of dietary protein to hemoglobin formation in the rat ..... 9
ORTEN, J. M. See Orten, A. U. ..... 9
OUTHOUSE, J. P., R. MILLS, H. BREITER, B. MCKEY, E. RUTHERFORD, W. ARMSTRONG AND H. H. MITCHELL. Man's utilization of dietary calcium ..... 8
OVERSTREET, M. R. See Abbott, O. D. 9
Oxidation, total, of carbohydrate in normal humans, effects of alimentary and adrenalin hyperglycemia on ..... 16

PANTOTHENIC acid and its nutritional significance ..... 7
PARSONS, H. T., J. GARDNER AND C. T. WALLIKER. Possible significance of fecal concentrations of the factor protective against egg white injury ..... 19
PATRICK, H. See Hogan, A. G. ..... 14
Pellagra and associated deficiency diseases as a medical and public health problem ..... 21
Pellagra, human, and experimental blacktongue, effect of nicotinic acid and coramine on ..... 14
Perosis, relation of, to unrecognized vitamins ..... 14
PERRY, H. M. See McHenry, E. W. 12
Phosphorus in hays, availability of 20
Possible significance of fecal concentrations of the factor protective against egg white injury ..... 19
Presentation of Mead Johnson Award for Research on Vitamin B Complex for 1940 ..... 5
Problem of promoting better human nutrition ..... 20
Proceedings of the American Institute of Nutrition, seventh annual meeting ..... 1
Protein, dietary, relation of, to hemoglobin formation in the rat ..... 9
Pyrazine acids and quinolinic acid, biological activity of ..... 8

QUINOLINIC acid, and pyrazine acids, biological activity of ..... 8
Quinones, certain antihemorrhagic, comparative activities of ..... 11

RABBITS, muscular dystrophy in, and the autoxidation of animal fats ..... 13
Rat, rate of digestion of some natural and synthetic fats in ..... 12
Rat, relation of dietary protein to hemoglobin formation in ..... 9
Rate of digestion of some natural and synthetic fats in the rat ..... 13
Rats on deficient diets, hemorrhagic adrenal necrosis in ..... 17
Relation of dietary protein to hemoglobin formation in the rat ..... 9
Relation of perosis to unrecognized vitamins ..... 14
Reproduction of "adequate" diets containing meat ..... 19
RICHARDSON, L. R. See Hogan, A. G. 14
ROOT, H. F. See Carpenter, T. M. ... 10
RUFFIN, J. M. See Smith, D. T. ... 14
RUTHERFORD, E. See Outhouse, J. P. . 8

SCHOOL children, a study of vitamin C nutrition in a group of ..... 16
Scurvy, observations on the relation of vitamin P to ..... 12
SEBRELL, W. H. See Daft, F. S. ... 17
SHEPHERD, M. L. See Hummel, F. C. 12
SMITH, A. H., D. J. BARNES AND C. E. MEYER. Metabolism of citric acid and of food citrate in infants ..... 8
SMITH, D. T., J. M. RUFFIN AND S. G. SMITH. The effect of nicotinic acid and coramine on experimental blacktongue and human pellagra ..... 14
SMITH, S. G. See Smith, D. T. ... 14
Spectroscopic studies of fatty acids ... 15
SPIES, T. D. Pellagra and associated deficiency diseases as a medical and public health problem ..... 21
Statement regarding administration of Mead Johnson award ..... 5
STIEBELING, HAZEL K. Dietary levels in the United States ..... 21
Studies of the vitamin B-complex with chicks ..... 17
Study of vitamin C nutrition in a group of school children ..... 16
SWANSON, P. P., AND P. M. NELSON. Reproduction on "adequate" diets containing meat ..... 19

THAYER, S. A. See Doisy, E. A. 10
Tocopherol, dl-Alpha, deficiency disease in chicks prevented by ..... 15

UNAVAILABLE carbohydrate balances of children ..... 12

VITAMIN $B_1$ deficiency, experimental, in man ..... 7
Vitamin B-complex with chicks, studies of ..... 17
Vitamin C nutrition in a group of school children, a study of ..... 16
Vitamin deficiency, anti-grey hair, in dogs and silver foxes ..... 18
Vitamin K ..... 10
Vitamin P, observations on the relation of, to scurvy ..... 12
Vitamins, unrecognized, relation of perosis to ..... 14

WALLIKER, C. T. See Parsons, H. T. ..... 19
WATERS, E. M. See Crane, Marian M. 16
WILDER, R. M. See Williams, R. D. 7
WILLIAMS, D. E., F. M. MACLEOD, E. MORRELL AND H. R. DUNCAN. Availability of phosphorus in hays 20
WILLIAMS, R. D. H. L. MASON AND R. M. WILDER. Experimental vitamin $B_1$ deficiency in man ..... 7
WILLIAMS, R. J. Pantothenic acid and its nutritional significance ..... 7
WOODS, P. W. See Crane, Marian M. 16

YOUMANS, J. B. The assessment of the nutrition of populations .. 21

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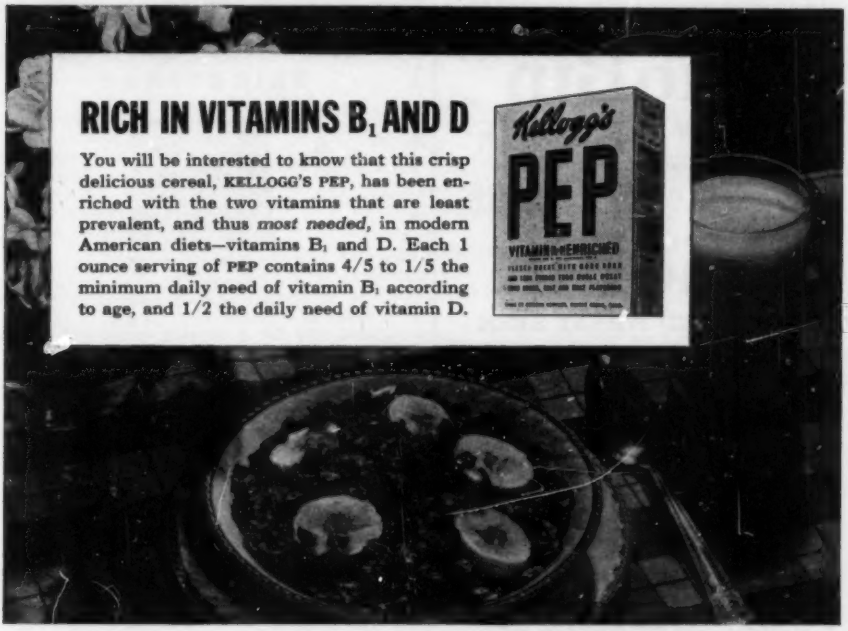
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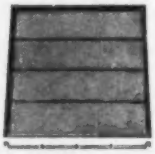

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# THE JOURNAL OF NUTRITION

VOL. 19 JUNE 10, 1940 No. 6 AND SUPPLEMENT

## CONTENTS

MAX KLEIBER, MURIEL D. D. BOELTER AND DAVID M. GREENBERG. Fasting catabolism and food utilization of calcium-deficient rats. One figure ... 517

MARGARET LAWRENZ, H. H. MITCHELL AND W. A. RUTH. Adaptation of the growing rat to the ingestion of a constant concentration of fluorine in the diet. Three figures ... 531

NOBUKO SHIMOTORI, GLADYS A. EMERSON AND HERBERT M. EVANS. The prevention of nutritional muscular dystrophy in guinea pigs with vitamin E ... 547

WALTER C. RUSSELL, M. WIGHT TAYLOR AND LOUIS J. POLSKIN. Fat requirements of the growing chick ... 555

J. R. HAAG AND L. D. WRIGHT. Cystine and methionine for growth and lactation ... 563

HELEN OLDHAM AND F. W. SCHLUTZ. The effect of different levels of vitamin $B_1$ and iron on the retention of iron and the fat content of normal young rats. One figure ... 569

ROBERT A. KEHOE, JACOB CHOLAK AND ROBERT V. STORY. A spectrochemical study of the normal ranges of concentration of certain trace metals in biological materials. One figure ... 579

R. D. WILLIAMS, L. WICKS, H. R. BIERMAN AND W. H. OLMSTED. Carbohydrate values of fruits and vegetables ... 593

MILDRED KING DIMICK. On the difference between thiamin deficiency in the rat and deficiencies of the other members of the vitamin B complex. One figure ... 605

JOHN W. BRATZLER AND E. B. FORBES. The estimation of methane production by cattle. One figure ... 611

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